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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/618,228	07/11/2003	Balgovind K. Sharma	SC125891P	4406

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John A. Fortkort P.C.
4512 Court of St. James
Austin, TX 78730

EXAMINER

TRAN, BINH X

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 06/24/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/618,228

Applicant(s)

SHARMA, BALGOVIND K.

Examiner

Binh X. Tran

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 April 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-29 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 22-28 is/are allowed.
- 6) ☒ Claim(s) 1-19, 21 and 29 is/are rejected.
- 7) ☒ Claim(s) 20 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 July 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>3-22-2005</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-5, 13-18, 21, 29 are rejected under 35 U.S.C. 102(b) as being anticipated by Sahbari (US 2002/0013239 A1).

Respect to claim 1, Sahbari discloses a method for cleaning a semiconductor device comprising the steps of:

providing a semiconductor device having organometallic processing residues on a surface thereof (paragraph 0032);

removing the residues through the application of a micellar solution (i.e. surfactant solution; paragraph 0028).

Respect to claims 2-3 and 15-16, Sahbari teaches the semiconductor device contains plurality of opening (i.e. via), and the opening has processing residues on a surface thereof which are formed during the creation of the opening, and wherein the micellar solution is applied to the opening to remove the processing residue (paragraph 0023, 0028, 0039). Respect to claim 4, Sahbari discloses the processing residues include organometallic polymer (paragraph 0032, 0039).

Respect to claim 5, Shbari discloses the semiconductor device has a low-k dielectric material includes hydrogen silsesquioxane (HSQ), and benzocyclobutene (BCB) (paragraph 0035). Sahbari does not explicitly disclose the dielectric constant for these materials. According to MPEP 2112.01, products of identical chemical composition cannot have mutually exclusive properties. A chemical composition and its properties are inseparable. Therefore, if the prior art teaches the identical chemical structure, the properties applicant discloses and/or claims are necessarily present. It is known in the art that HSQ layer has a dielectric constant $k \approx 2.8$ (See Aoki US 6,423,148, col. 7 lines 40-43). Therefore, the examiner interprets that Sahbari implicitly discloses a semiconductor device has a bulk dielectric constant k below 3.0.

Respect to claims 13-14, and 17 Sahbari discloses the semiconductor device contains copper level and silicon, wherein the surfactant (read on micellar solution) is used to clean the surface (paragraph 0043, 0053). The limitation of claim 18, 21 have been discussed above. Respect to claim 29, Sahbari discloses the solution does not contain hydroxylamine solvent (example 7, paragraph 0053; read on "devoid of hydroxylamine solvents").

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 6, 8-9, 12, 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sahbari in view of Aoki (US 6,423,148)

Respect to claims 6 and 19, Sahbari discloses to use nonionic, anionic and cationic surfactants at the concentration of 0.2 wt% or 0.5 wt% (paragraph 0028, read on applicant's range of "less than about 1% by weight"). Sahbari fails to disclose that the surfactant is hydrocarbon surfactant. Aoki discloses to use anionic surfactant include carboxylic acid surfactant (col. 5 lines 57-67, read on "hydrocarbon surfactant"). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Sahbari in view of Aoki by using hydrocarbon surfactant because equivalent and substitution of one for the other would produce an expected result. Respect to claim 8, Aoki discloses the surfactant is carboxylic acid (read on "having at least one carboxyl group").

Respect to claim 9, Aoki discloses the solution comprises oxalic acid to remove metal impurities at higher efficiency (col. 6 lines 35-45). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Sahbari in view of Aoki by using oxalic acid because it will enhance metal impurities removal process. Respect to claim 12, Aoki teaches to use either oxalic acid (as discussed above) or citric acid (col. 6 lines 40-45).

5. Claims 7, 10 rejected under 35 U.S.C. 103(a) as being unpatentable over Sahbari in view of DeYoung (US 6,641,678).

Respect to claim 7, Sahbari fails to disclose the micellar solution comprises a fluorocarbon surfactant. However, Sahbari clearly discloses that the micellar solution

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comprise nonionic, anionic or cationic surfactant (paragraph 0028). In a cleaning method, DeYoung teaches to use either carboxylic acid (anionic surfactant) or fluorocarbon surfactant (col. 6 lines 20-24). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Sahbari in view of DeYoung by using fluorocarbon surfactant because equivalent and substitution of one for the other would produce an expected result.

Respect to claim 10, DeYoung discloses the solution comprises aqueous solution of fluoro-surfactant and HF acid (col. 5 lines 22-35 and col. 6 lines 23-25). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Sahbari in view of DeYoung by using aqueous solution of fluoro-surfactant and HF because it will enhance and facilitate the cleaning process.

6. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sahbari in view of Bessho et al. (US 6,440,856).

Respect to claim 11, Sahbari fails to disclose that the solution comprise ethylene glycol monobutyl ether. However, Sahbari clearly discloses the solvent includes propylene glycol monomethyl ether (paragraph 0022). In a cleaning method using surfactant, Bessho teaches to use ethylene glycol monobutyl ether or propylene glycol monomethyl ether as a solvent (col. 9 lines 15-28). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Sahbari in view of Bessho by using ethylene glycol monobutyl ether because equivalent and substitution of one for the other would produce an expected result.

Allowable Subject Matter

7. Claim 20 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

8. Claims 22-28 are allowed.

9. The following is a statement of reasons for the indication of allowable subject matter: The cited prior arts fail to disclose or suggest the step of removing residues by contacting residue with a micellar solution, wherein the micellar solution comprises, by weight, about 0.01% to about 1% hydrocarbon surfactant, about 1-10% citric acid, about 1-10% oxalic acid, and about 1-10% ethylene glycol monobutyl ether in conjunction with all other limitation in the claim.

Response to Arguments

10. Applicant's arguments with respect to claims 1-19, 21, 29 rejections based on Robison et al. (US 6,103,627) reference in previous office action have been considered but are moot in view of the new ground(s) of rejection. According to applicants, silicon dioxide particles residues in Robinson's reference were created during the polishing process. The examiner agrees with applicants. The examiner does not use Robinson as a reference in office action.

Conclusion

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X. Tran whose telephone number is (571) 272-1469. The examiner can normally be reached on Monday-Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should

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you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Binh X. Tran

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER

A handwritten signature in black ink, appearing to be 'N. Norton', written below the printed name and title.